



University of California Cooperative Extension

Fresno Kern Madera Riverside San Bernardino San Diego San Luis Obispo Santa Barbara Tulare Ventura Counties
Volume 1 No. 2 April - June, 2003

News from the Subtropical Tree Crop Farm Advisors in California

Editor's Note:

This is the second issue of our quarterly newsletter. Dr. Peggy Mauk is the editor for this issue. The next issue will be edited by Dr. Ben Faber, UCCE Ventura County. Although our newsletter will emphasize citrus and avocado, we will also discuss other subtropical plants as well. Please let us know if there are specific topics that you would like for us to address. If you would like to change the information on the mailing label, add your email address to receive the electronic issue or add someone else to the mailing list, please call or send an email message to the farm advisor in the county where you live. Phone numbers and email addresses can be found at the end of this newsletter. Thank you for your outstanding response to the first issue of newsletter. We appreciate your interest and your support. Best regards, Peggy Mauk

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Cooperative Extension (CE) tailors its programs to meet local needs. CE's many teaching tools include meetings, conferences, workshops, demonstrations, field days, video programs, newsletters, manuals and personal consultations.

In Riverside County and throughout the state, thousands of volunteers extend CE's outreach, assisting with 4-H youth development programs along with Master Gardeners.

The Vice President (Dr. Reg Gomes) of the Division of Agriculture and Natural Resources (ANR) is the Director of Cooperative Extension and is responsible for all programs within Cooperative Extension.

Cooperative Extension exists in almost every county in the United States and always involves a partnership between the USDA, the state's Land Grant University, and the county or local government. Each partner plays a key role in providing funding and support for Cooperative Extension programs.

The University provides academic and program support staff who plan and conduct programs for county residents. The academic staff in each county usually consists of Farm Advisors (agricultural sciences), Nutrition, Family, Consumer Sciences Advisors, and 4-H Youth Development Advisors. The USDA provides program support dollars for EFNEP (Expanded Food & Nutrition Education Program), FSNEP (Food Stamp Nutrition Education Program), and Youth EFNEP low-income nutrition education programs. Each county in California usually provides clerical and other support personnel, office space, program supplies, staff travel, and other administrative support.

The Director of Cooperative Extension for each county (County Director) is the liaison between the University of California and the County Board of Supervisors. The County Director, in cooperation with the Regional Director, is responsible for the program staff and the administration and management of county extension programs. The County Director is responsible for ensuring that the Cooperative Extension programs conform to: University policy; federal, state, and local laws; safety and health regulations; affirmative action guidelines; and the mission core values and educational objectives of the 4-H Youth Development Program.

Who are we? University of California Cooperative Extension (UCCE)

By Peggy Mauk, County Director/Subtropical Horticulture Advisor, Riverside County

UC Cooperative Extension is the statewide branch of the University of California that provides research based education to the public. We have offices in almost every county throughout the state. We cooperate and work with the various campuses; however, our administration is under the office of the Vice President of the Division of Agriculture and Natural Resources. The delivery of Cooperative Extension programs including 4-H is a partnership between federal, state, and county governments. The Smith-Lever Act of 1914, as amended, provides guidelines and specific functions for extension programs.

The University of California prohibits discrimination against harassment of any person on the basis of race, color, national origin, religion, sex, physical or mental disability, medical condition (cancer related or genetic characteristics), ancestry, marital status, age, sexual orientation, citizenship, or status as a covered veteran (special disabled veteran, Vietnam-era veteran or any other veteran who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized). University policy is intended to be consistent with the provisions of applicable State and Federal laws. Inquiries regarding the University's nondiscrimination policies may be directed to the Affirmative Action/Staff Personnel Services Director, University of California, Agriculture and Natural Resources, 300 Lakeside Drive, Oakland, CA 94612 (510) 987-0096.

## Citrus Leafminer, new pest to California

By Peggy Mauk, County Director/Subtropical Horticulture Advisor, Riverside County

Have you ever seen mines of your citrus leaves? If you have, did you assume that the mines on fruit were the same as the mines on the leaves? They aren't! Leaf mines are caused by the citrus leafminer a fairly new pest to California (2000) and to Riverside County (2002). This small moth lays eggs on the newly emerging leaves of citrus. The citrus leafminer does not cause mines on the fruit or on stems, those are from the peelminer. The citrus leafminer generally mines the underside of the leaf. Under high populations, however, citrus leafminer will mine the upper (figure 1A) and lower leaf surfaces. Another distinguishing characteristic of this insect is that it leaves frass trails in the mines (figure 1B). One of the characteristics of this pest that can be easily seen is the edge of the leaf rolls downward as the larvae pupate (figure 1C). Because young trees and nursery trees tend to produce abundant amounts of flush growth throughout the year they are more prone to damage by citrus leafminer than mature trees. The citrus leafminer was first found in Imperial County in 2000. The pest is a strong flier and is capable of migrating great distances. By 2001, it had migrated across the desert from Calexico to Niland. By 2002 it was found in Riverside County, near the western edge of the Salton Sea.

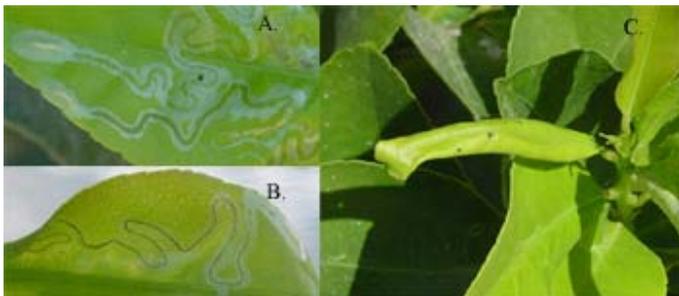


Figure 1. A. Larval mines on upper leaf surface. B. Typical frass lines within the larval mine. C. Leaf curls with pupae underneath the curl of the leaf.

For the 2002 season, the citrus leafminer was found in several groves. Although it did not reduce yields or cause other direct losses being an "A"-rated organism, it caused problems for packers since they could not move citrus originating from an infested area to a non-infested area. Fruit picked within the quarantine zone had to be picked leaf-free or packed within the quarantine zone. On January 3, 2003, the past status was downgraded to a "B"-rated organism. This means that citrus packinghouses in non-infested areas should accept fruit and bins from citrus leafminer infested areas (1) if they can be inspected (certified) at their origin and found apparently free from green citrus foliage OR (2) if fruit and bins are covered (tarped) to reduce the risk of foliage being blown out during transport. Once tarped bins are in the packinghouse they must collect and destroy all green foliage associated with citrus fruit and harvest bins.

In November 2002, we initiated a trial, to evaluate various chemicals for controlling citrus leafminer. This research is being supported by the California Citrus Nursery Advisory Board. We have conducted the work in a commercial lemon grove on 9 month old trees. We selected 12 products to test, some of which are organic. Of the chemicals that are applied to the foliage, Agrimek and Assail were most successful in controlling citrus leafminer. Agrimek, is only registered for use in commercial citrus. Dr. John Heraty, Professor of Entomology, UC Riverside has a research project evaluating the potential for biological control of citrus leafminer. He and his assistant Marta Guillen, have had promising results. In the long run, biological control should provide enough control that pesticides may not be necessary outside of the nurseries. For more information: <http://www.uckac.edu/citrusent/>

## Not all 'Medjool' date plants grown in California are the same!

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The date palm (*Phoenix dactylifera* L.) made its way to California through the Spanish missions in the late seventeenth century. In its native ranges of North Africa and the Middle East, the date provided food, fiber and shelter. As commercial date production established in the interior valleys of California and Arizona, growers sought out new varieties. Introductions of varieties from Algeria, Tunisia, Egypt and Iraq between 1890 and 1922, laid the foundations of the modern California date industry. W.T. Swingle brought offshoots of 'Deglet Noor' to California in 1900. Recognized as a superior variety for three hundred years in the oases of Algeria and other North African countries, 'Deglet Noor' is now one of the most significant cultivars in California and worldwide. In 1927, Swingle also introduced the 'Medjool' date to California. 'Medjool', probably originated in the Tafilat district of Morocco, takes its place beside 'Deglet Noor' as one of our most important date varieties.

From its beginnings as few thousand imported offshoots, the California date industry has grown to annual harvests totaling \$23-30 million dollars, according to 2001 USDA statistics. The approximately 5,600 acres of date palms in California account for more than 95% of the U.S. industry, supplying dates for consumption and mature trees for the expanding landscape market. The varieties 'Deglet Noor' and 'Medjool', amongst a few others, remain the mainstay of this strong niche landscape industry. While there have been no important cultivars introduced into the U.S. in recent years, there are over three thousand different cultivars grown worldwide. Examining these cultivars and making comparisons with those cultivars grown in California, will allow researchers to make new introductions best suited for our industry.



*Young 'Medjool' palm grown in the Coachella Valley.*

The long history of cultivation has obscured the origins of the date palm, thought to be a native of western India or possibly southern Iraq. Identifying cultivars can be difficult, as this is done primarily through morphological characteristics such as the fruit, leaf bases or spines. Environmental factors such as soil or weather can influence these characteristics, which are generally only observable on mature trees of at least 3-5 years of age. The names associated with date cultivars also create some confusion. In some parts of the world, a date known by one name at an oasis might be called something completely different a few hundred miles away. To add to the confusion, dates also exhibit intra-varietal variations. These variations, such as differences in fruit size, ripening time or vegetative characteristics, were first reported in the early 1920's. Researchers originally thought the differences between palms of one variety were due to the chance that the plant had come from a seedling instead of an offshoot thus having different varietal characteristics because it was a hybrid and not a clone from the parent plant. Those plants were grown and marketed under the name of the parent cultivar. Modern researchers, using amplified fragment length polymorphism (AFLP) markers, a polymerase chain reaction (PCR) based molecular markers, can now evaluate genetic diversity and fingerprinting of the date cultivars. In a recent study at UC Riverside, we examined 23 samples of 'Medjool' and 33 samples of 'Deglet Noor' date using AFLP markers (The Journal of Horticultural Science and Biotechnology, 2003, 78(5): 405-409). The samples for this study were collected from the USDA National Clonal Germplasm Repository for Citrus and Dates at the UC Coachella Valley Research Station, Thermal, CA and from commercial date gardens in the Coachella Valley. Our results showed that there is almost no genetic difference amongst the 33 'Deglet Noor' date samples; however we identified a wide range in genetic variation within the 'Medjool' samples. Among 23 'Medjool' date samples tested, 3 had the same genetic profiles. In total, we identified 20 different types of

'Medjool' dates. How can we explain such large difference found in 'Medjool' dates in California? The differences could have originated when horticulturists originally introduced 'Medjool' into California in the early 1900s. The plants could have been mistakenly identified, mislabeled, or mistakenly propagated from seedlings instead of clonal offshoots. Another possible explanation for the genetic variation could be that 'Medjool' palms have a high rate of mutation. The differences we found in 'Medjool', however, are too large to be explained by a high mutation rate, we believe another explanation is more likely. We propose that the 'Medjool' date that was introduced into California originated from a "landrace" variety in the Tafilalt district of Morocco, where 'Medjool' was initially selected. A "landrace" variety means that the variety is endemic to an area (in the case of 'Medjool' in the Tafilalt district of Morocco), it is a mixture of different genotypes and well adapted to the local environment. It is possible that the initial introductions of 'Medjool' were in reality different genotypes of 'Medjool' and these different genotypes exist in current plantings. On the contrary, all 33 'Deglet Noor' dates that we tested are almost the same genetically. 'Deglet Noor' seems to exist as a pure variety without much variation.

Growers in California have observed differences in fruit quality and yield of 'Medjool' date in the past, but the variation always have been attributed to xenia effect, location, environmental, or management practices. Our results imply that the differences in production between 'Medjool' date palms may be due to genetic differences and not just cultural differences. Field testing is needed to determine if the differences in fruit quality and yield between plants is related to genetic differences between plants. For this, we need to plant a trial where we are able to evaluate genetically different strains of 'Medjool' palms grown under the same environmental conditions. Potentially, some strains of 'Medjool' may have higher yield and better fruit quality than other selections; these can be selected for propagation thereby having the potential to increase grower's returns.

In the future, we would like to examine 30-50 different 'Medjool' samples collected from Morocco using the AFLP markers to confirm or dispute the possibility that 'Medjool' date exists as a landrace variety in Morocco. We also are collecting samples of offshoots from the same 'Medjool' palm to determine if high mutation rate exists in 'Medjool' dates. By learning more about the varieties grown in California and abroad, we hope to select varieties that would increase the vitality of the date industry in California.

## **Avocado Pruning Survey**

*By Ben Faber and Gary Bender, UCCE Farm Advisors in Ventura and San Diego County, respectively*

What do you do with those big, ornery avocado trees when you hear all kinds of cautions about pruning them? We asked attendees at the 2002 Avocado Research Symposium what their

experiences had been with both orchard regeneration and maintenance pruning. These two techniques are distinguished by the degree of pruning required. In the case of regeneration, it is taking the overly large tree and bringing it into a size that can then be managed in a less drastic format. Maintenance pruning is managing tree size once they have been brought under control.

Of the approximately 200 attendees, there were 25 respondents. Most of the respondents were from San Diego County. Most of the growers had been doing some type of pruning since 1998. Several had only pruned in the last two years. Two had pruned for as long as 25 and 16 years. Growers reported as little as 0.5 acre pruned to as much as 1000 acres. More than half had pruned more than 20 acres.

In the survey we asked which methods they had used to regenerate and maintenance prune, what the costs had been and what impact the practice had had on production. We also asked if they would repeat the practice and whether they had other comments about the practices. In not all cases were the costs of the practice known and whether all the costs associated with the method (cutting, limb removal, grinding, etc.) were reported. Several growers reported that they had used numerous techniques and were able to critique each of the methods. Table 1 lists the costs that were associated with the different styles of regeneration pruning and the time it took the tree to return to flowering.

Table 1. Average cost associated with a given pruning style and years until flowering returns to the tree. Where there is no range in the cost, there was only one respondent who used the method

Style	\$/tree (range)	Time to flowering (range)
3 ft. stump (n=7) <sup>1</sup>	\$13.71 (\$3-28)	2-4 years
8 ft. stump (n=1)	\$20	Not reported
12-16 ft. scaffold (n=1)	\$20	Next year
2 branch removal (n=3)	\$10 (\$5-15)	Next year
Hedgerow (one side each year) (n=1)	\$10	Next year
Open vase (n=1)	?	2 years
Thinning (every other tree) (n=5)	\$18.60 (\$18-20)	Next year
<sup>1</sup> (n=) the number of respondents following the method.		

Most of this regenerative pruning occurred in the winter and spring with some reporting that they pruned pre-bloom in November and December. Only one reported regenerating in the summer. Based on their experiences, only 2 out of the 25

would not go through a regeneration process, however 5 would do it another way. The major complaints were with the 3-foot stumping and the problem with controlling the vegetative regrowth. The 5 growers who had thinned out every other tree were content with the positive impact on yield, but 3 said the trees were getting too big now.

As for maintenance pruning, more growers reported that they would often do this year round, probably as labor was available. Of the 24 who indicated they did follow one of the methods, 10 of them did not know the cost or length of time to perform the practice. This was quite different for those who had done regenerative pruning, where most knew the cost. The cost averages and ranges are shown for these pruning styles in Table 2. Where no cost range is present in the table it is due to the lack of reporting information.

Table 2. Average cost and harvest yield in pounds associated with a maintenance pruning style.

Style	\$/tree (range)	Yield (range)
Pyramid (Christmas tree) (n=4) <sup>1</sup>	\$2	9,500 (4-15) <sup>2</sup>
Hedgerow (n=5)	\$15 (\$10-20)	12,000 (7-15)
2-Branch removal (n=2)	\$4	4,000
Selective branch, maintained 12-15 ft. (n=7)	\$10.60 (\$2-30)	9,300 (3-16)
Topping @ 15 ft. (n=1)	\$4	13,000
Open vase (n=5)	\$4.67 (\$2-10)	8,300 (4-10)
<sup>1</sup> (n=) the number of respondents following the method.		
<sup>2</sup> in 1000 pounds		

This survey is only a guide to grower experience with managing tree canopies. Initial tree size and health, crowding, soil type, solar exposure and climate are all going to affect the results that growers are reporting. This variability is reflected in the costs associated with the various techniques. For example in "Selective branch" removal in Table 2, the costs range from \$2-30 per tree. This wide range may be due to farm size and economies of scale or it could be differing tree size on terrain that is easier or harder to do the work. Another point to keep in mind is that this is still a small sample of 25 growers, although they are reporting a total of 1,675 acres pruned by one of these techniques.

The yield for a given grower was not reflected in the expense paid for the pruning. As is normal for avocado, the yields are all over the place. Something to keep in mind is that of the 24 respondents reporting to do maintenance pruning, only 4 had yields less than the State average of 7,000 pounds to the acre and the averages of all but one of the techniques exceeded the state average.

# Dry Root Rot of Citrus

By Nick Sakovich, UCCE Farm Advisor in Ventura County

## Introduction

Dry Root Rot has menaced growers in Ventura County for many years. In the '50's and '60's it seemed most prevalent on older orange trees. A few years after the wet winter of 1968-69, dry root rot became an increasing problem among citrus trees of all ages. At that time, most of the damaged trees were on sweet rootstock (susceptible to *Phytophthora*), and growing in fine-textured soils or soils with poor drainage. A few years after another wet winter/spring (of 1983), dry root rot again reared its ugly head, but this time predominately on young lemons.

The disease is caused by the fungus, *Fusarium solani*. This fungus is most likely present in all citrus soils in California. It is a weak pathogen in that by itself it will not attack a healthy tree. However, experiments conducted in the early 1980's by Dr. Gary Bender, showed that when seedlings were girdled, root invasion occurred. In the field, the fungus can infect trees once gophers have girdled the roots or crown. A *Phytophthora* infection will also predispose trees to *Fusarium*, as will asphyxiation. Therefore, the mere presence of the fungus in the orchard soil will not lead to the disease.

## Description

*Fusarium* is a soil borne fungus that invades the root system. Once infected, the entire root will turn reddish-purple to grayish-black. This is in contrast to a *Phytophthora* infection which, in many cases, will attack only the feeder roots, but when larger roots are infected, only the inner bark is decayed and it does not discolor the wood. In addition, when observing the cross section of a dry root rot infected trunk, a grayish-brown discoloration in the wood tissue can be observed.

Dry root rot is a root disease, but symptoms of the root decline are seen above ground. They are similar to any of the root and crown disorders such as *Phytophthora* root rot, oak root rot fungus (*Armillaria*) and gophers. The trees lack vigor, leaves begin to turn yellow and eventually drop (especially in hot weather) causing twig dieback. Finally, the foliage will become so sparse that one will be able to see through the canopy of the tree. A period of two to three years may pass from the time of invasion until noticeable wilt. Many times, the tree will collapse in the summer, after a period of prolonged heat. In the case of dry root rot, the collapse is so rapid that the tree dies with all the leaves still on the tree. When looking for symptoms of dry root rot, keep an eye out for symptoms of other maladies as well — *Phytophthora*, oak root rot fungus and gophers being the most prevalent.

As mentioned previously, in order for *Fusarium* to infect a tree, there must be a predisposing factor such as girdling from gopher feeding. However, since many trees collapse from dry root rot without any apparent predisposing factor, there are

obviously other factors which we have yet to identify. Therefore, in 1998, a grower survey was developed, along with intensive soil and leaf sampling, to attempt to identify as many new predisposing factors as possible. They might be elements in the soil, either deficiencies or excesses, or specific cultural practices such as irrigation patterns or fertilizer practices. Twenty orchards were identified from which 20 soil and 20 leaf samples were taken in diseased areas and another 20 soil and 20 leaf samples were taken from adjacent healthy areas. The owners or managers of the properties were given a questionnaire to complete regarding a variety of cultural operations. The objective was to identify those factors that would correlate well to trees becoming infected with dry root rot.

## Survey Results

*Soil analysis* - The following laboratory procedures were conducted to see if there was any correlation between the disease and either deficiencies or toxicities of these elements or conditions: sodium, boron, salt level, pH and soil type (sand, loam, clay). For these elements or conditions, no correlation was found. It would appear that for our sampling sites, these conditions, whether favorable or not (toxic or deficient), did not play a major role in predisposing the tree to dry root rot.

*Leaf analysis* - The following elements were analyzed for their concentration within the leaf: nitrogen, potassium, phosphate, manganese, magnesium and zinc. Of these, three correlations were found. Zinc and manganese levels were substantially higher in diseased trees. The third correlation showed a potassium deficiency in diseased trees. However, we do not believe that dry root rot is caused by elevated levels of zinc or manganese, or by potassium deficiency, but rather are a result of the disease. Unfortunately, it seems that we have still not identified any elements in leaf analysis that truly correlates and points to a predisposing factor for disease development.

*Grower survey* - The grower survey included questions on planting site (location, wind, previous crop, fumigation etc.), trees (source, type, rootstock, etc.), and cultural practices (irrigation, fertilization, gophers, history of *Phytophthora*, water quality, etc). Through statistical analysis it was found that the healthy and diseased sites were significantly different with reference to three conditions or situations: 1.) *The presence of Phytophthora* in an orchard will increase the chance of those trees succumbing to dry root rot. 2.) Orchards that have been *fumigated* have a *less likely chance* of succumbing to dry root rot. 3.) *Balled vs. Container Plants* -- growers were asked if their trees were balled or container grown nursery plants. Healthy sites were significantly more likely to have been planted with balled trees (73% vs 33%). The results of this analysis were not strong, but rather they suggest that there is a relationship between the disease and the type of tree planted - balled or container grown - and suggesting in favor of a balled tree for a healthy orchard.

## Control Measures – What Works and What Does Not

Early experiments conducted by Menge, Ohr and Sakovich showed that the following circumstances or operations do not influence the incidence of this disease: fungicidal treatments, wounding the tap root at time of planting, sandy versus clay textured soils, spring versus fall planting and soil mounding.

*Rootstocks.* In choosing your nursery tree, the choice of rootstock is not important in that, as far as we know, all rootstocks are susceptible to this disease. However, since *Phytophthora* is a major component in dry root rot development, choosing a rootstock like sweet orange would certainly put those trees in a high risk category. We recommend that growers use *Phytophthora* resistant rootstocks like C35 or Citrumelo.

*Fumigation.* According to the survey, it would be advantageous to fumigate before planting. Methyl bromide, although expensive, is the best fumigant as it is a complete biocide. If one chooses not to fumigate, the alternative would be a number of fungicide/nematicide applications to the newly planted trees. Generally speaking, this may work well with trees planted on a rootstock like Citrumelo or C35.

*Phytophthora.* Publications written in the 1970's, and again noted by our survey, showed that *Phytophthora* is a major culprit in the dry root rot complex. To control dry root rot, it is essential that the *Phytophthora*, when present, be controlled. This can be accomplished by fungicidal treatments, and by the proper application and timing of irrigation water. Over-watering creates a favorable environment for the multiplication of the *Phytophthora* fungus.

*Gophers.* It is well known that gopher damage provides entry points for *Fusarium*. Controlling gophers is an important factor in reducing the potential of infection by *Fusarium*.

## Control

We presently have no direct control for dry root rot. To control the disease, we must control the predisposing factors such as gophers, *Phytophthora*, poor drainage and over-watering. If the predisposing factor(s) cannot be identified for a given diseased orchard, it will indeed be difficult to control the disease. Two things are certain though: 1.) There are no chemicals to date which will control this disease; and 2.) Presently, there are no rootstocks resistant to the disease.

## Future Projects

There are a number of ongoing research projects in Ventura County attempting to unravel the dry root rot mystery. Some of these projects target identification of more predisposing factors. Still other projects are aimed at increasing understanding of the fungus itself and how the disease occurs.

Trial 1 - Addresses the potential problem of using a soil auger in clay soils to dig the planting hole. We suspect that doing this will create a planting hole with slick sides, having the effect of sealing the hole. This will temporarily hamper the roots from

growing outward into the surrounding soil, thus creating a pot-bound condition and predisposing the trees to dry root rot.

Trial 2 – In an orchard with a history of dry root rot, we are replanting with container grown nursery trees versus bareroot (balled) nursery trees. As indicated by our survey, there is a correlation between container grown trees and the occurrence of this disease. In this experiment we will be able to verify this relationship.

Trial 3 – Same as Trial 2, but using “bench” or “J” rooted trees versus normal nursery trees. This will enable us to see if certain types of abnormal root growth predispose trees to the disease. Another treatment in this test is the application of unincorporated gypsum to the soil.

In the above trials, we are growing comparison trees. If our supposition is correct, within five years a larger number of those trees with a predisposing factor to dry root rot should die. For example in trial 2, if container trees are more predisposed to dry root rot than balled trees, a higher proportion of those will die compared to the bareroot trees.

## Additional projects

1. We are analyzing healthy trees compared to diseased trees for their starch levels to see if starch depletion may play a role in the onset of this disease. Preliminary results so far, indicate no correlation between starch depletion and the disease.
2. The mushroom fungus *Coprinus* is often observed growing next to diseased trees. We are presently investigating this relationship to see if *Coprinus* may be a factor in the dry root rot complex.
3. Although we are dealing with a known species, *Fusarium solani*, it is possible that we are dealing with more than one race of this species. One race may be a toxin producer causing the trees to succumb to dry root rot. The other may be a non-toxin producer where no disease is produced. Through molecular analysis, we are investigating if different strains of *Fusarium* do exist.

On a closing note, it has recently been discovered that there is a triggering mechanism which will cause this fungus under certain, as yet unknown, environmental conditions to begin producing chemicals which are toxic to plants. This mechanism is governed by a gene which is present on a unique type of chromosome called a dispensable chromosome. This entire chromosome may be ignored for years and the fungus may not be pathogenic. However, when utilized, this chromosome harbors toxin genes, which may turn the fungus into the dry root rot pathogen. This is a real breakthrough. The key now will be to ascertain what conditions trigger the change and how we can prevent it.

## Upcoming Educational Opportunities:

**Citrus Grower Seminars** (co-sponsored UCCE/ Citrus Research Board) 9 AM to 1 PM all locations:

- Santa Paula – **July 18**
- Tulare – **July 22**
- Orland – **October 29**
- Temecula – **November 4;**
- Indio – **November 5**

For details please check the following web site:  
(<http://www.citrusresearch.org>)

### Blueberry meeting

- San Luis Obispo at Cal Poly- San Luis Obispo, Aug 5, 8 AM to 12 PM
- Ventura Aug 6 at Faulkner Farm 8 AM to 12 PM (for more information contact Ben Faber at 805-645-1462)

### Lychee meeting

- Ventura, 9 AM to 12 PM, Aug 13 at the UCCE
- Fallbrook, 1 PM to 4 PM, Aug 14 at the RCD office (for more information contact Ben Faber at 805-645-1462)

### Avocado Grower Meetings:

- WATER – and the things we add to soil at 3 locations: **August 12**, 8 AM to 10 AM, UCCE office in San Luis Obispo; **August 12**, 1 to 3 PM at UCCE office in Ventura, **August 14**, 1 to 3 PM Escondido (for more information contact CAS office at 805-562-8366)
- Avocado Brainstorming '03, International Symposium in Ventura, **October 30 to November 1**  
(<http://www.ucavo.ucr.edu>, <http://avocadosource.com> )

Some of the links listed in this publication are to sites outside of the UC domain. No endorsement is intended of products, services or information, nor is criticism implied of similar sites that are not mentioned.

UC Avocado Info: <http://www.ucavo.ucr.edu>

UC Fruit & Nut: <http://fruitsandnuts.ucdavis.edu>

UC Avocado Production Cost Data (Ventura and San Diego):  
<http://coststudies.ucdavis.edu/cost-studies/AvoVent2001-2.pdf>  
<http://coststudies.ucdavis.edu/cost-studies/AvoSDiego2001.pdf>

UCCE Riverside County: <http://ceriverside.ucdavis.edu/>

UC Ag Economics Cost studies: <http://coststudies.ucdavis.edu>

UC Avocado Biocontrol: <http://www.biocontrol.ucr.edu>

California Rare Fruit Growers:

<http://www.crfg.org/pubs/frtfacts.html>

UC Small Farm Center: <http://www.sfc.ucdavis.edu/>

UC Sustainable Agriculture Research and Education Center:  
<http://www.sarep.ucdavis.edu/>

Questions and Answers to Citrus Management:

[http://ucce.ucdavis.edu/counties/ceriverside/newsletterfiles/Questions\\_and\\_Answers\\_to\\_Citrus\\_Management2489.pdf](http://ucce.ucdavis.edu/counties/ceriverside/newsletterfiles/Questions_and_Answers_to_Citrus_Management2489.pdf)

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